

Airport Pavement CPR

Applications and Limitations of Diamond Grinding and Grooving.



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Why CPR on Airports ?

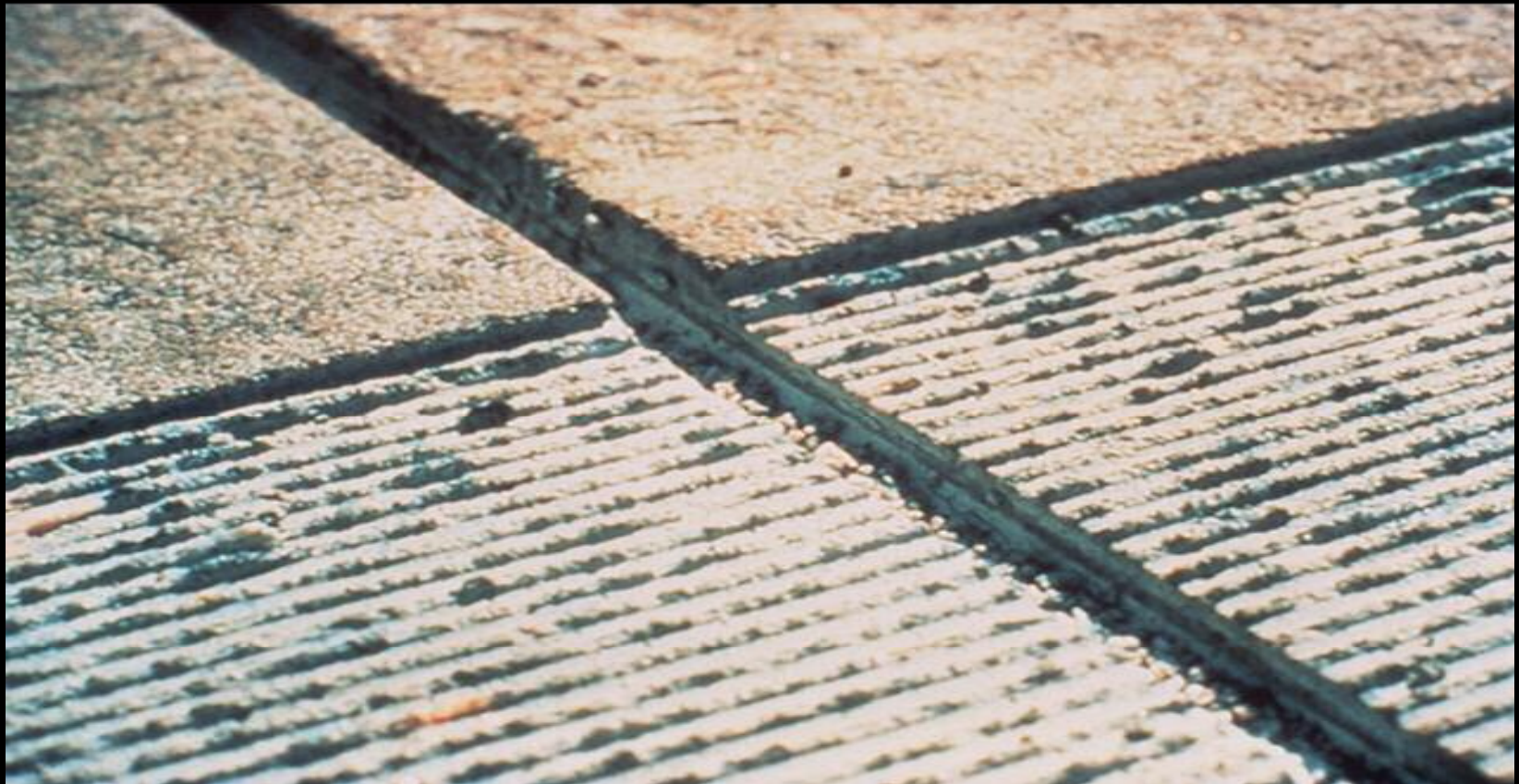
- Pavement deterioration
 - Foreign Object Damage (FOD)
- Eliminate pavement roughness
 - Extend the life of pavements and planes
- Reduced down time due to major repairs

Restoration Techniques

Concrete Pavements

- Full-depth repair
- Partial-depth repair
- Diamond grinding
- Joint & crack resealing
- Slab stabilization
- Retrofitting dowels
- Cross-stitching long. cracks/joints
- Pavement Grooving

Diamond Grinding



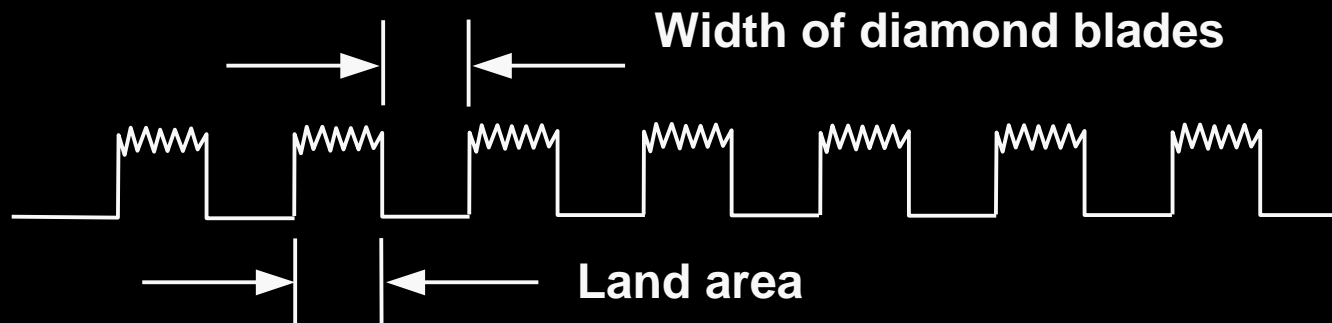
What is Diamond Grinding?

- Removal of thin surface layer of hardened PCC using closely spaced diamond saw blades
- Results in smooth, level pavement surface
- Longitudinal texture with desirable friction characteristics
- Frequently performed in conjunction with other CPR techniques, such as full-depth repairs, dowel bar retrofit, retrofit edgedrains

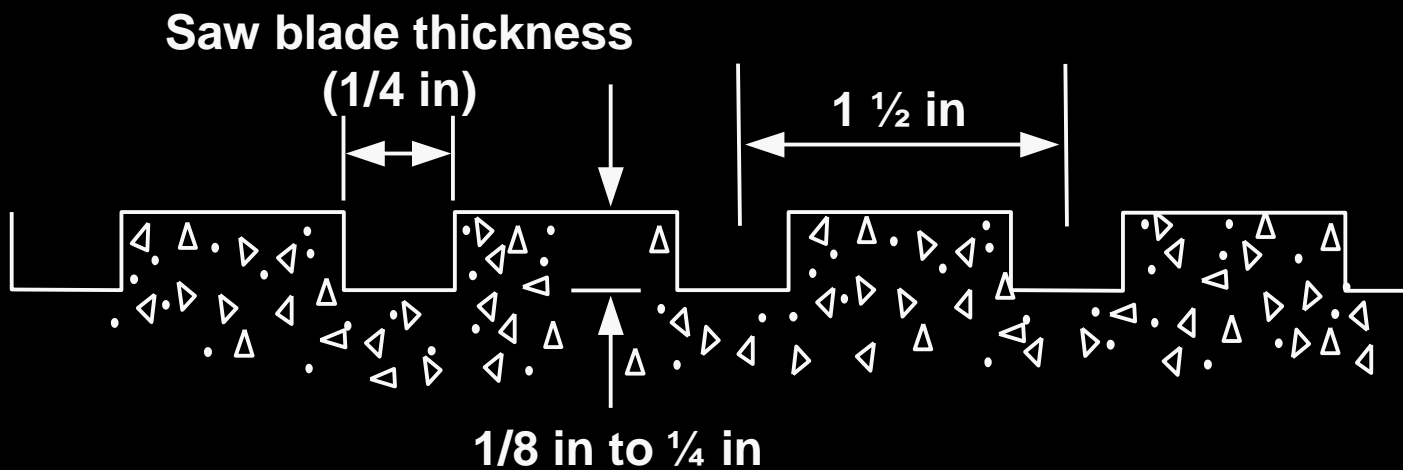
Airport Runway Grinding

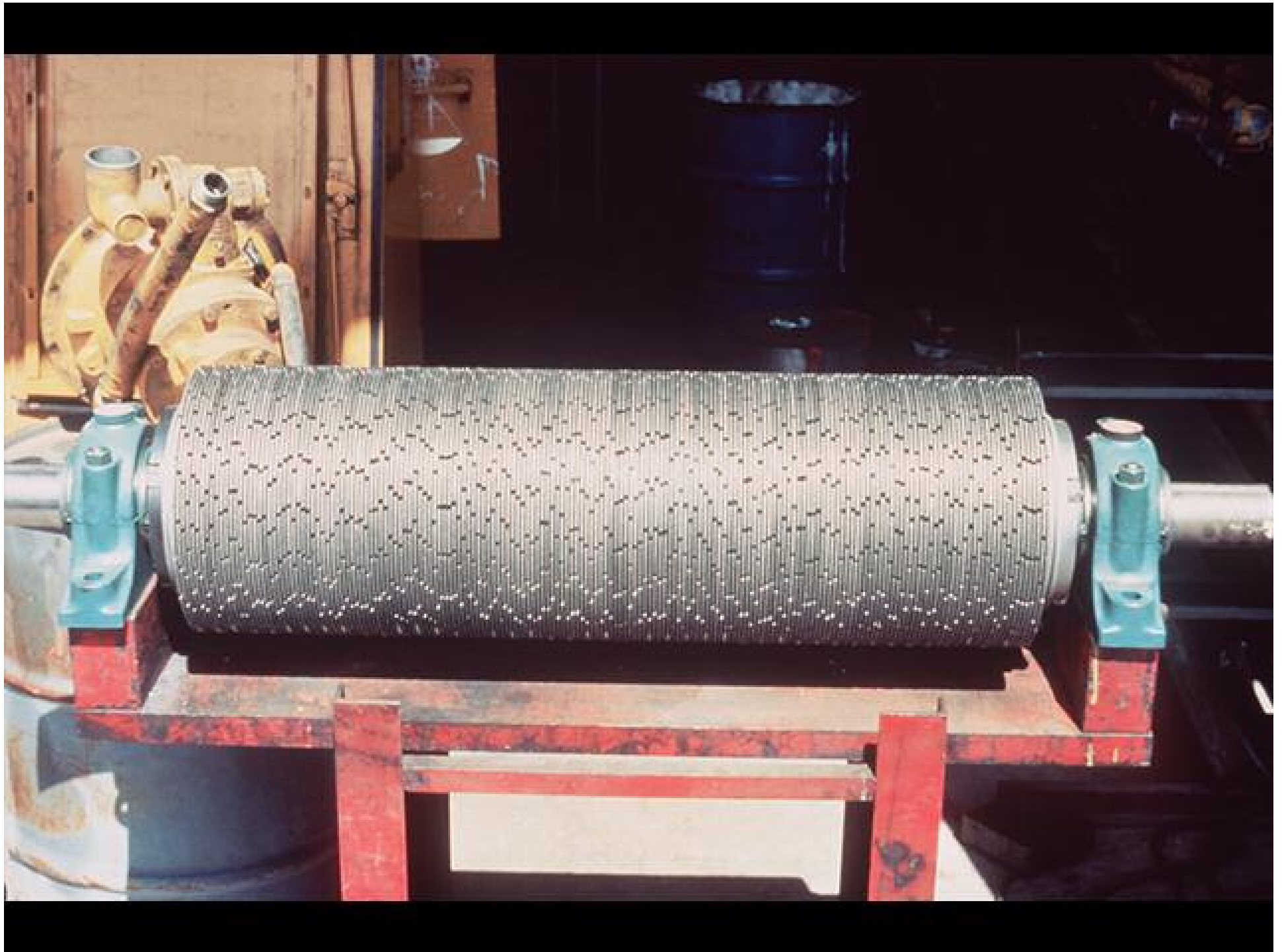
- Runway pavement is ground the same way that it is grooved, except that the diamond blades are spaced closer together and the grinding texture is longitudinal rather than transverse to the centerline

Diamond Grinding



Diamond Grooving









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Why Grind a runway?

- Eliminate pavement roughness
- Correct faulted pavement
- Correct curling and warping
- Blend patched/repaired pavement with original pavement
- Eliminate pavement depressions
- Increase skid resistance

Safety



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Longevity

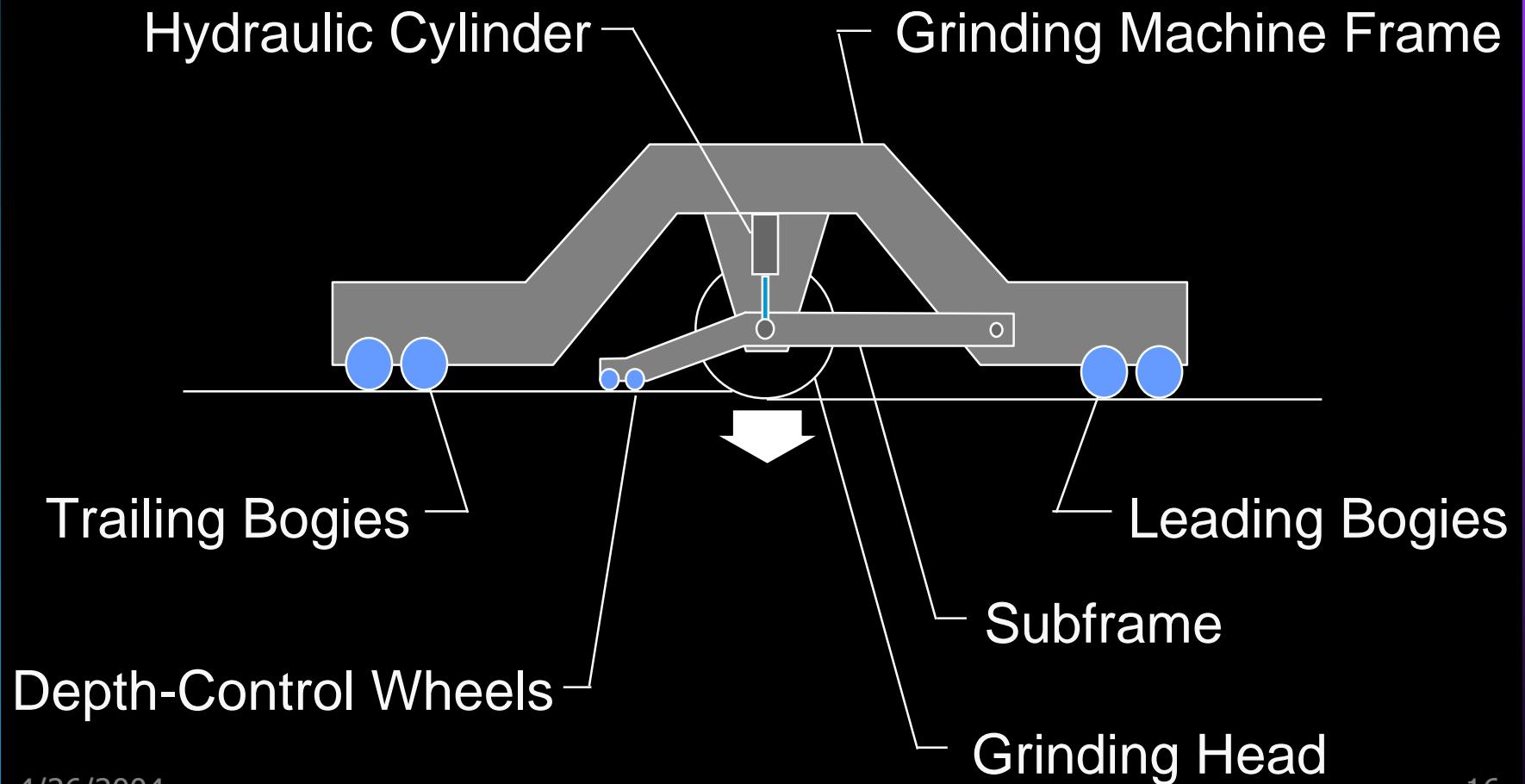


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How is Runway Grinding Done?

- Runways are ground parallel to the centerline
- Runways can be ground to within 2 feet of ends and edges
- Runways are ground up to 6", but not over 24" from recessed center line and touchdown lights or other embedment in runway

Basic Components





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Evaluate Rideability

- California profilograph (or similar)
- Take traces before and after grinding
- Should be able to provide 70% improvement over pre-grind profile
- Verify profile index against specification requirement

Airport Runway Grooving



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What is Runway Grooving?

- A procedure that utilizes diamond tipped circular saw blades, mounted and evenly spaced on a horizontal shaft, to cut channels through which water can drain from the pavement surface.



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Safety Grooving for Runways

- First used by British in 1956 to improve friction characteristics of wet runways
- NASA begins runway grooving research in 1962
- Adopted as a standard technique used to improve runway characteristics in 1967

Safety Grooving for Runways

- First commercial use at Washington National Airport in 1967 – transverse grooves sawed into bituminous surface, .625" X .625" X 1"
- First commercial use on a PCC runway at Kansas City International Airport in 1968, .25" X .25" X 1.25"

Safety Grooving for Runways

- Standardized by FAA in 1978 via Advisory Circular
- Grooves sawed transverse to runway
- .25" X .25" X 1.5"
- AKA Deep Groove Concept
- Most major airports in the US contain at least one grooved runway



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- “Grooving is like motherhood: you just can’t find anything wrong with it.”

Walter Horne
NASA Director of Research

Benefits of Runway Grooving

- Improved external water drainage on runway
- Improved internal water drainage between tire footprint and pavement surface
- Improved friction characteristics due to tire/pavement interlocking

Improved External Water Drainage

- Increases macro-texture of pavement surface. Increased rainfall rates required to start surface flooding
- Polished groove channels greatly reduce water flow resistance compared with rough pavement surfaces

Improved External Water Drainage

- Adverse effects of surface winds on water drainage are reduced
- Grooved pavement drains up to 10 times faster than un-grooved surfaces



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Improved Internal Water Drainage

- Grooves provide “escape route” for water trapped between tire and pavement surface
- Reduces the potential for hydroplaning

Hydroplaning

- The condition that exists when a pneumatic tire rolling or sliding across a water-covered pavement is lifted away from the pavement surface onto a thin film of water. Total hydroplaning is when the tire loses the ability to develop frictional values necessary for vehicle deceleration and directional control!

Improved Friction Characteristics

- Interlock of tire tread rubber with pavement grooves increases friction coefficient
- Optimum configuration determined by NASA is .25" X .25" X 1.5" for AC and PCC
- Can restore tire friction coefficients on wet pavements to near dry pavement friction levels



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Improved Friction Characteristics

- Uniform spacing of the grooves creates a homogenizing effect which produces a more uniform friction surface
- By reducing the magnitude and amount of fluctuations in the friction coefficient, a more effective braking surface is produced

Summary of NASA Report

- “The Pilot’s observations indicated that transverse grooved surfaces drastically reduced all types of skids on a wet or flooded runway and provided positive nose-gear steering during the landing roll-out.”

Summary of NASA Report

- “The overall airplane ground handling and stopping characteristics on the grooved surfaces showed a dramatic improvement over those on corresponding un-grooved surfaces with no observable adverse characteristics from the pilots point of view”

How is Runway Grooving Done?

- Runways are grooved perpendicular to centerline
- Runways are grooved to within 5 feet on either end and within 10 feet of each edge
- Grooving is often done at night to minimize traffic disruption

How is Runway Grooving Done?

- Runways are grooved up to 6" but not more than 24" from recessed centerline touchdown lights or other embedments in runway
- Measurement is accomplished with random checks to determine groove depth, width and spacing

Costs of Safety Grooving

- Dependent on
 - Size of project
 - Aggregate type
 - Size of aggregate
 - Work schedule

Cost of Safety Grooving

- Asphalt runway grooving, range \$.50 to \$1.50 per sq yd
- Concrete runway grooving, range \$1.25 to \$3.00 per sq yd

Factors Effecting Groove Durability

- Traffic loading and oxidation (AC surfaces)
- Shoving/distortion (AC surfaces)
- Numerous rubber removal operations can polish and/or remove pavement surface
- Note: Groove durability is greatly increased in PCC pavements!

Slurry Removal

- Slurry **MUST** be vacuumed from the runway...**NOT** just rinsed
- Deposit in grassy areas adjacent to runway
- Rinse runway with water when vacuum operation is completed



Conclusions

- Many restoration techniques are available to extend the life of your pavements.
- Timely CPR is a low cost alternative to resurfacing or reconstruction.
- The IGGA and ACPA is willing and able to help with your pavement needs.
- For more information, check out www.igga.net and www.pavement.com